Ovintiv USA Inc. – Pumpjack Engine Emission Measurement Inspections – Uinta Basin, Utah Wellpads – On-Site Partial Compliance Evaluations (PCE)

Inspection Dates: **Inspection Report Date**:	7/27/2022, 7/28/2022, 8/3/2022, 8/4/2022 11/15/2022
Inspection Report Prepared By:	Youn Joo Kim, US EPA
Inspection Report Reviewed By:	Scott Patefield, Manager, US EPA Region 8, Enforcement and Compliance Assurance Division, Air and Toxics Enforcement Branch
EPA Inspectors:	Inspectors from EPA Region 8, Enforcement and Compliance Assurance Division, Air and Toxics Enforcement Branch • Sara Loiacono (7/27/2022, 7/28/2022) • Youn Joo Kim (7/27/2022, 7/28/2022) • Colin LeCortz (8/3/2022, 8/4/2022) • Katelyn Bergl (8/3/2022, 8/4/2022)
Company Representatives:	Brian Webb, Mechanic Coordinator Jeanette Liang, EHS RJ McClure, Sr. Air Compliance Specialist Kevan Stevens, Field Compliance Coordinator
Tribal Representatives:	None
State Representatives:	Kyle Greenberg, Utah Division of Air Quality (UDAQ) (7/27/2022, 7/28/2022) Chris Jensen, UDAQ (8/3/2022)
Parent Company Address:	370 17th Street, Suite 1700 Denver, CO 80202
Facilities County/State Location:	Uintah and Duchesne/Utah
EPA Region:	Region 8
Specific Facility Information:	See Table 1

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Inspection Information

As part of a regional effort to better characterize emissions from pumpjack engines, the United States Environmental Protection Agency (EPA) conducted engine performance testing at 24 wellpads owned by Ovintiv USA Inc. in the Uinta Basin in Utah. The objective of the testing was to evaluate compliance with regulatory emission limits, verify point source pollutant levels used for air quality modeling and emission inventories, assess the effectiveness of engine emission regulatory limits, and evaluate the emissions maintenance practices of individual operations. The engine emission tests were conducted by a third-party contractor, Alliance Source Testing (AST).

Over three weeks of engine testing in the Uinta Basin, the EPA and its contractor conducted testing at 75 pumpjack engines with four operators. The sample population was created to reflect the universe of almost 3,400 pumping spark-ignition engines as provided in the 2017 Uinta Basin Emission Inventory – by operator, by engine make and model, by age of engine, and by jurisdiction.

Table 1 – Sites Inspected

Date	Operato	Facility	Well Name	Latitude	Longitud
7/27/2022	Ovintiv	Monuments Butte State 15-36-8-16	Greater Monument Butte B-1-9-16	40.06949	-110.065
7/27/2022	Ovintiv	Monuments Butte State 15-36-8-16	Monument Butte East State R-36-B-16	40.06949	-110.065
7/27/2022	Ovintiv	Balcron Mon Fed 42-6-9-17	Jonah Federal J-6-9-17		
7/27/2022	Ovintiv	Balcron Mon Fed 42-6-9-17	GMBU 117-6-9-17		
7/27/2022	Ovintiv	Balcron Mon Fed 42-6-9-17	GMBU 115-6-9-17		
7/27/2022	Ovintiv	Monument Butte State 15-2-9-16	South Monument Butte W-2-9-16	40.05463	-110.083
7/27/2022	Ovintiv	Monument Butte State 15-2-9-16	South Monument Butte V-2-9-16	40.05463	-110.083
7/27/2022	Ovintiv	Monument Butte 1-14-9-16	Greater Monument Butte T-2-9-16		
7/27/2022	Ovintiv	Monument Butte 1-14-9-16	Greater Monument Butte A-11-9-16		
7/28/2022	Ovintiv	Wells Draw 1-4-9-16	GMBU B-4-9-16	40.06515	-110.116
7/28/2022	Ovintiv	Wells Draw 1-4-9-16	GMBU F-3-9-16	40.06515	-110.116
7/28/2022	Ovintiv	Ashley 13-11-9-15	GMBU D-14-9-15	40.03995	-110.205
7/28/2022	Ovintiv	Ashley 13-11-9-15	GMBU A-15-9-15	40.03995	-110.205
7/28/2022	Ovintiv	Ashley 10-10-9-15	GMBU 10-9-15	40.04355	-110.214
7/28/2022	Ovintiv	Ashley 12-11-9-15	GMBU T-10-9-15	40.04326	-110.206
7/28/2022	Ovintiv	Ashley 14-2-9-15	Greater Monument Butte W-2-9-15	40.05412	-110.200
7/28/2022	Ovintiv	Ashley 14-2-9-15	GMBU R-2-9-15	40.05412	-110.200
8/3/2022	Ovintiv	Jonah Federal 13-14-9-16	Jonah Federal Q-14-9-16	40.02487	-110.093
8/3/2022	Ovintiv	Johan (Federal) 14-14-9-16 CTB	GMBU C-23-9-16	40.02505	-110.089
8/3/2022	Ovintiv	Federal 7-21-9-16 CTB	GMBU I-21-9-16	40.01773	-110.122
8/3/2022	Ovintiv	Federal 10-21-9-16 CTB	Federal 10-21-9-16	40.01475	-110.121
8/3/2022	Ovintiv	Jonah Federal 2-13-9-16 CTB	GMBU C-13-9-16	40.03639	-110.064
8/3/2022	Ovintiv	Federal 1-13-9-16 CTB	GMBU F-18-9-17	40.03684	-110.06
8/3/2022	Ovintiv	Jonah 9-12-9-16 CTB	GMBU P-7-9-17	40.04338	-110.06
8/3/2022	Ovintiv	Jonah Federal 13-12-9-16 CTB	GMBU R-12-9-16	40.03925	-110.066
8/4/2022	Ovintiv	Stewart 16-20-4-2	Stewart 16-20-4-2	40.11498	-110.125
8/4/2022	Ovintiv	Stewart 2A-29-4-2 CTB	Stewart 2A-29-4-2	40.11168	-110.13
8/4/2022	Ovintiv	Moon 4-29-4-2	Moon 4-29-4-2	40.11156	-110.134
8/4/2022	Ovintiv	Moon 1-29-4-2	Moon 1-29-4-2	40.10794	-110.140
8/4/2022	Ovintiv	Ashley Federal 7-27-9-15 CTB	GMBU L-27-9-15	40.00289	-110.216
8/4/2022	Ovintiv	Ashley Federal 7-27-9-15 CTB	GMBU I-27-9-15	40.00289	-110.216
8/4/2022	Ovintiv	Ashley Federal 12-26-9-15	GMBU T-27-9-15	40.00004	-110.206
8/4/2022	Ovintiv	Ashley Federal 12-26-9-15	GMBU K-27-9-15	40.00004	-110.206
8/4/2022	Ovintiv	Ashley Federal 5-26-9-15 CTB	GMBU G-26-9-15	40.0034	-110.205
8/4/2022	Ovintiv	Ashley Federal 5-26-9-15 CTB	GMBU J-27-9-15	40.0034	-110.205

Information that couldn't be obtained such as missing longitudes and latitudes, during the inspection was requested on 8/24/22.

The inspection team adhered to the following approach for the engine measurements:

1) On 7/27/2022, the EPA inspectors, AST and UDAQ attended the safety training at the Ovintiv field office. An Ovintiv Health, Safety, Security and Environment (HSSE) representative confirmed that a hot work permit would not be necessary for the engine performance testing. At the beginning of each day of the inspection, the EPA met Ovintiv representatives, UDAQ and AST at the Ovintiv field office and shared a list of targeted engines for each day of the inspection. Ovintiv representatives plotted the routes to targeted engine sites as efficiently as possible.
2) AST positioned their testing trailer to be a safe distance from the process equipment.
3) AST began set up and conducted the calibration of the analyzers at the first site each day. Following the calibration, AST conducted a pre-bias quality control check, then a 21-minute measurement with pollutants recorded each minute, followed by a post-bias check. Whenever the analyzers were shut down due to a faulty power source, the analyzer was recalibrated before any data was collected.
4) Through visual observation and interview of Ovintiv personnel, the EPA gathered information on the operating parameters of the engine, the associated equipment around each engine, the maintenance schedules, and other engine specific information. Table 3 summarizes the information collected during and after the inspection.
5) The summary of performance test results are in Table 4.

Performance Testing Information

Performance tests were conducted to determine the emission rates of nitrogen oxides (NOx), carbon monoxide (CO) and non-methane hydrocarbons (NMHC) from the engine exhausts in grams/hp-hr (Table 4).

Emission rates were calculated using the Wyoming Analyzer Protocol, Page 25, Section 10.1.2. Where manufacturer-specified Brake Specific Fuel Consumption (BSFC) in BTU/HP-hr and nameplate horsepower were available, those were used in calculations for emission mass rates. For site-rated hp, nameplate hp was adjusted to account for site elevation at 5,000 feet above sea level. Where they were not available, the Wyoming Analyzer Protocol default value of 9,400 BTU/hp-hr was used. Where manufacture year or horsepower were not available on the engine nameplate, or there was no nameplate, the year and horsepower noted were identified by the EPA relying on emission inventory data submitted by Ovintiv (or its predecessor, Encana).

The emission testing program was conducted in accordance with the test methods listed in Table 2. Method descriptions are provided in Attachment A - AST Performance Test Report.

Table 2 – Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Carbon Monoxide	10	Instrumental Analysis
Volumetric Flow Rate	19	Fuel Factors / Heat Inputs
Non-Methane Hydrocarbons	25A	Instrumental Analysis
Gas Dilution System Certification	205	--

Other Field Notes

Inspector observed all Arrow L-795 engines have tags which state "At the time of manufacturer this engine was non-certified and does not meet EPA Regulations. It is the owner/operator's responsibility to comply with current EPA regulations."

From the last EPA inspection conducted by Cindy Beeler in 2021, Brian Webb described the work of their in-house mechanics staff and the schedule of routine maintenance as reflected in the engine inspection checklist forms that he sent via email to Cindy Beeler on 9/16/21. Additionally, he stated that Ovintiv is working on getting these forms in an electronic version that may look a little different but will still cover the same information – see Attachment B. These checklists cover 4-stroke quarterly, 2-stroke lean burn (2SLB) yearly, and 2SLB semi-annual engine inspections.

However, conflicting information was collected during the 2022 inspections. Brian Webb noted that there are no maintenance schedules and there are no documents used by Ovintiv which would identify poorly operating engines. Engines are maintained when the field operators report on engines not "operating well" such as abnormal sounds. He also stated that the air to fuel ratio is adjusted manually and typically set to max-out the fuel flow to ensure complete combustion. Tuning of the engines is also not documented when it occurs and though Ovintiv has portable analyzers, they are not being used to adjust any engine parameters.

The inspector(s) could not observe the pressure of the fuel gas entering the engines because many sites did not have pressure gauges, or gauges in place were not operating.

The engines run continuously, even if the pumpjack is not pumping. Engine operation without pumpjack operation is sometimes referred to as "clutched" or idled" operation and is used to generate power for heat trace circulation pumps that provide a heated medium throughout the wellpad (tank heaters, heater treater, heat trace along piping, etc.).

Seeking Ovintiv Review and Input

The EPA would like to better understand what could influence pumpjack engine emissions and so seeks your review and input on the equipment associated with each engine. This is described more fully in the inspection report where EPA requests your confirmation of the following:

1. Confirm the engine Make/Model, nameplate HP, serial #, and engine category (e.g., 2SLB, 4SRB) of the engines listed in **Table 3.**

2. Provide maintenance records specified below for each engine listed in **Table 3.**
    a. Date, Time, and the name of the operator performing the maintenance work;
    b. Date and time of the oil and filter change(s);
    c. Date and time of spark plug change(s);
    d. Date and time of inspection of hoses and belts;
    e. Date and time of engine tuning (ex. Adjusting air to fuel ratio);
    f. Hours of operations for each engine.

3. Provide documentation of any performance testing conducted on the engines listed in **Table 3**, including the results from the performance testing, the date the testing was conducted, and the name of the individual who performed the testing.

4. Provide documentation of the use of portable emissions analyzers on the engines listed in **Table 3**, including results, the name of the individual who performed the testing, and the following information for the portable emissions analyzer:

    a. Manufacturer;
    b. Serial Number;
    c. Calibration Dates;

d. Dates and results of QA QC checks.

5. Specify the fuel source for each engine in **Table 3.** (Ex. Ashley gas plant)

6. Provide fuel analysis records for both well head gas (emergency use) and gas supplied from treatment plants.

7. Provide records of when well head gas was utilized to operate the engines.

8. Provide engine manufactured year for the engines listed in **Table 3.**

9. Provide a certificate of conformity for each engine listed in **Table 3**.

Table 3 – Engine and Fuel Information

Facility	Well Name	Latitude	Longitude	Make	Model	Serial Number	Horsepower	Engine Category	Mfg Year	Air Filter Type	Fuel Gas Source	Autoclutch
Monuments Butte State 15-36-8-16	Greater Monument Butte B-1-9-16	40.06949	-110.0659	Arrow	L-795	L-600315	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Monuments Butte State 15-36-8-16	Monument Butte East State R-36-B-16	40.06949	-110.0659	Arrow	L-795	L-600319	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Balcron Mon Fed 42-6-9-17	Jonah Federal J-6-9-17			Ajax	DP80	617180	78	4SRB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Balcron Mon Fed 42-6-9-17	GMBU 117-6-9-17			Ajax	E-565	36362	40	2SLB	2014	Oil Bath	Process Gas/ Casing Gas	No
Balcron Mon Fed 42-6-9-17	GMBU 115-6-9-17			Ajax	E-565	36181	40	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Monument Butte State 15-2-9-16	South Monument Butte W-2-9-16	40.05463	-110.0837	Arrow	L-795	L600300	Unknown	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Monument Butte State 15-2-9-16	South Monument Butte V-2-9-16	40.05463	-110.0837	Arrow	L-795	L-600301	Unknown	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Monument Butte 1-14-9-16	Greater Monument Butte T-2-9-16			Arrow	L-795	600445	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Monument Butte 1-14-9-16	Greater Monument Butte A-11-9-16			Arrow	L-795	L600415	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Wells Draw 1-4-9-16	GMBU B-4-9-16	40.06515	-110.1162	Ajax	DP80	54154	77	4SRB	Unknown	Oil Bath	Process Gas/ Casing Gas	No

Facility	Well Name	Latitude	Longitude	Make	Model	Serial Number	Horsepower	Engine Category	Mfg Year	Air Filter Type	Fuel Gas Source	Autoclutch
Wells Draw 1-4-9-16	GMBU F-3-9-16	40.06515	-110.1162	Arrow	L-795	600575	78.3	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Ashley 13-11-9-15	GMBU D-14-9-15	40.03995	-110.2053	Arrow	L-795	L601156	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	Yes
Ashley 13-11-9-15	GMBU A-15-9-15	40.03995	-110.2053	Arrow	L-795	L-601160	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Ashley 10-10-9-15	GMBU 10-9-15	40.04355	-110.2142	Arrow	L-795	L-601114	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Ashley 12-11-9-15	GMBU T-10-9-15	40.04326	-110.2062	Arrow	L-795	L-601080	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Ashley 14-2-9-15	Greater Monument Butte W-2-9-15	40.05412	-110.2006	Arrow	L-795	600390	65	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Ashley 14-2-9-15	GMBU R-2-9-15	40.05412	-110.2006	Arrow	L-795	600807	78.3	2SLB	Unknown	Oil Bath	Process Gas/ Casing Gas	No
Jonah Federal 13-14-9-16	Jonah Federal Q-14-9-16	40.02487	-110.093	Ajax	DP60	67774	60	2SLB	nr	Oil Bath	Field Gas	No
Johan (Federal) 14-14-9-16 CTB	GMBU C-23-9-16	40.02505	-110.089	Arrow	L-795	AEL-79S13S	65	2SLB	nr	Oil Bath	Field Gas	No
Federal 7-21-9-16 CTB	GMBU I-21-9-16	40.01773	-110.122	Ajax	E-565	86163	40	2SLB	2012	Air Cartridge	Field Gas	No
Federal 10-21-9-16 CTB	Federal 10-21-9-16	40.01475	-110.121	Ajax	E-42	53486	42	4SRB	nr	Oil Bath	Field Gas	No
Jonah Federal 2-13-9-16 CTB	GMBU C-13-9-16	40.03639	-110.064	Ajax	DP60	61730	60	2SLB	nr	Air Cartridge	Field Gas	No
Federal 1-13-9-16 CTB	GMBU F-18-9-17	40.03684	-110.06	Arrow	L-795	600610	78.3	2SLB	nr	Oil Bath	Field Gas	No
Jonah 9-12-9-16 CTB	GMBU P-7-9-17	40.04338	-110.06	Arrow	L-795	ABL 795018	65	2SLB	2013	Oil Bath	Field Gas	No

Facility	Well Name	Latitude	Longitude	Make	Model	Serial Number	Horsepower	Engine Category	Mfg Year	Air Filter Type	Fuel Gas Source	Autoclutch
Jonah Federal 13-12-9-16 CTB	GMBU R-12-9-16	40.03925	-110.0668	Ajax	L-795	AAL795016	65	2SLB	2013	Oil Bath	Field Gas	No
Stewart 16-20-4-2	Stewart 16-20-4-2	40.11498	-110.125	Ajax	E-42	60644	42	4SRB	nr	Oil Bath	Field Gas	No
Stewart 2A-29-4-2	Stewart 2A-29-4-2	40.11168	-110.13	Ajax	E-42	55615	42	4SRB	nr	Oil Bath	Field Gas	No
Moon 4-29-4-2	Moon 4-29-4-2	40.11156	-110.134	Ajax	E-42	49369	42	4SRB	nr	Oil Bath	Field Gas	No
Moon 1-29-4-2	Moon 1-29-4-2	40.10794	-110.1402	Ajax	E-42	67245	42	4SRB	2009	Oil Bath	Field Gas	No
Ashley Federal 7-27-9-15 CTB	GMBU L-27-9-15	40.00289	-110.2162	Ajax	E-565	86361	42	2SLB	2014	Air Cartridge	Field Gas	No
Ashley Federal 7-27-9-15 CTB	GMBU I-27-9-15	40.00289	-110.2162	Ajax	E-565	86193	42	2SLB	2012	Air Cartridge	Field Gas	No
Ashley Federal 12-26-9-15	GMBU T-27-9-15	40.00004	-110.206	Ajax	E-565	86395	42	2SLB	2014	Air Cartridge	Field Gas	No
Ashley Federal 12-26-9-15	GMBU K-27-9-15	40.00004	-110.206	Ajax	E-565	86392	42	2SLB	2014	Air Cartridge	Field Gas	No
Ashley Federal 5-26-9-15 CTB	GMBU G-26-9-15	40.0034	-110.2059	Ajax	E-565	66150	42	2SLB	2012	Air Cartridge	Field Gas	No
Ashley Federal 5-26-9-15 CTB	GMBU J-27-9-15	40.0034	-110.2059	Ajax	E-565	86091	42	2SLB	2012	Air Cartridge	Field Gas	No

Table 4 – Performance Test Results from Alliance Source Testing with NSPS JJJJ Exceedances (Highlighted in Red)

Facility	Well Name	Make	Model	Serial Number	Horsepower	Engine Category	Mfg Year	BSFC (Btu/HP-hr)	CO*	NOx*	CH4*	NMHC*
Monuments Butte State 15-36-8-16	Greater Monument Butte B-1-9-16	Arrow	L-795	L-600315	65	2SLB	Unknown	12081	41	3.84	0.0059	48.7
Monuments Butte State 15-36-8-16	Monument Butte East State R-36-B-16	Arrow	L-795	L-600319	65	2SLB	Unknown	12081	137.2	0.1	0.0039	75.7
Balcron Mon Fed 42-6-9-17	Jonah Federal J-6-9-17	Ajax	DP80	617180	78	4SRB	Unknown	8900	3.42	0.02	0.0041	96.4
Balcron Mon Fed 42-6-9-17	GMBU 117-6-9-17	Ajax	E-565	36362	40	2SLB	2014	13300	3.7	0.046	0.0058	121.7
Balcron Mon Fed 42-6-9-17	GMBU 115-6-9-17	Ajax	E-565	36181	40	2SLB	Unknown	13300	2.49	0.094	0.006	109.5
Monument Butte State 15-2-9-16	South Monument Butte W-2-9-16	Arrow	L-795	L600300	Unknown	2SLB	Unknown	12081	78.4	0.21	0.0024	64.4
Monument Butte State 15-2-9-16	South Monument Butte V-2-9-16	Arrow	L-795	L-600301	Unknown	2SLB	Unknown	12081	70.3	0.2	0.0022	58.2
Monument Butte 1-14-9-16	Greater Monument Butte T-2-9-16	Arrow	L-795	600445	65	2SLB	Unknown	12081	126.1	0.12	0.0039	86.3
Monument Butte 1-14-9-16	Greater Monument Butte A-11-9-16	Arrow	L-795	L600415	65	2SLB	Unknown	12081	76.7	0.53	0.0026	64.9
Wells Draw 1-4-9-16	GMBU B-4-9-16	Ajax	DP80	54154	77	4SRB	Unknown	8900	3.7	0.022	0.0032	68.6
Wells Draw 1-4-9-16	GMBU F-3-9-16	Arrow	L-795	600575	78.3	2SLB	Unknown	12081	72.4	0.17	0.0023	25.9
Ashley 13-11-9-15	GMBU D-14-9-15	Arrow	L-795	L601156	65	2SLB	Unknown	12081	34.4	2.38	0.0024	33.3
Ashley 13-11-9-15	GMBU A-15-9-15	Arrow	L-795	L-601160	65	2SLB	Unknown	12081	77.4	0.29	0.0023	28.1
Ashley 10-10-9-15	GMBU 10-9-15	Arrow	L-795	L-601114	65	2SLB	Unknown	12081	94.5	0.28	0.0044	28.9
Ashley 12-11-9-15	GMBU T-10-9-15	Arrow	L-795	L-601080	65	2SLB	Unknown	12081	92.03	0.63	0.0029	47.8
Ashley 14-2-9-15	Greater Monument Butte W-2-9-15	Arrow	L-795	600390	65	2SLB	Unknown	12081	110.7	0.14	0.0033	36
Ashley 14-2-9-15	GMBU R-2-9-15	Arrow	L-795	600807	78.3	2SLB	Unknown	12081	27.6	0.25	0.0018	14.5

Jonah Federal 13-14-9-16	Jonah Federal Q-14-9-16	Ajax	DP60	67774	60	2SLB	Unknown	9000	3.03	0.035	0.47	54.1
Johan (Federal) 14-14-9-16 CTB	GMBU C-23-9-16	Arrow	L-795	AEL-79S13S	65	2SLB	Unknown	12081	67.8	0.48	0.22	38.8
Federal 7-21-9-16 CTB	GMBU I-21-9-16	Ajax	E-565	86163	40	2SLB	2012	13300	2.54	0.095	0.67	84.8
Federal 10-21-9-16 CTB	Federal 10-21-9-16	Ajax	E-42	53486	42	4SRB	Unknown	13300	61.9	0.073	0.7	55.9
Jonah Federal 2-13-9-16 CTB	GMBU C-13-9-16	Ajax	DP60	61730	60	2SLB	Unknown	9000	3.47	0.11	0.69	34
Federal 1-13-9-16 CTB	GMBU F-18-9-17	Arrow	L-795	600610	78.3	2SLB	Unknown	12081	59.5	0.18	0.65	32.5
Jonah 9-12-9-16 CTB	GMBU P-7-9-17	Arrow	L-795	ABL 795018	65	2SLB	2013	12081	53.8	0.23	0.69	33.1
Jonah Federal 13-12-9-16 CTB	FMBU R-12-9-16	Ajax	L-795	AAL795016	65	2SLB	2013	12081	0.39	0.39	0.16	12.4
Stewart 16-20-4-2	Stewart 16-20-4-2	Ajax	E-42	60644	42	4SRB	Unknown	13300	0.07	0.07	0.16	24.6
Stewart 2A-29-4-2	Stewart 2A-29-4-2	Ajax	E-42	55615	42	4SRB	Unknown	13300	0.098	0.098	0.12	23.2
Moon 4-29-4-2	Moon 4-29-4-2	Ajax	E-42	49369	42	4SRB	Unknown	13300	0.043	0.043	2.57	103.2
Moon 1-29-4-2	Moon 1-29-4-2	Ajax	E-42	67245	42	4SRB	2009	13300	1348.4	0	6.85	576.6
Ashley Federal 7-27-9-15 CTB	GMBU L-27-9-15	Ajax	E-565	86361	42	2SLB	2014	13300	4.05	0.028	5.43	246.4
Ashley Federal 7-27-9-15 CTB	GMBU I-27-9-15	Ajax	E-565	86193	42	2SLB	2012	13300	3.07	0.64	2.2	109.2
Ashley Federal 12-26-9-15	GMBU T-27-9-15	Ajax	E-565	86395	42	2SLB	2014	13300	5.53	0.04	2.5	114.5
Ashley Federal 12-26-9-15	GMBU K-27-9-15	Ajax	E-565	86392	42	2SLB	2014	13300	5.64	0.025	1.11	52.3
Ashley Federal 5-26-9-15 CTB	GMBU G-26-9-15	Ajax	E-565	66150	42	2SLB	2012	13300	3.72	0.072	1.11	52.5
Ashley Federal 5-26-9-15 CTB	GMBU J-27-9-15	Ajax	E-565	86091	42	2SLB	2012	13300	3.74	0.046	0.87	44.59

*Performance test results are in grams/hp-hr

Areas of Concern

The performance test data has identified engine emissions in exceedance of the limitations found in the New Source Performance Standards, Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (NSPS Subpart JJJJ):

> §60.4233(d) Owners and operators of stationary SI ICE with a maximum engine power greater than 19 KW [25 HP] and less than 75 KW [100 HP] . . . must comply with the emission standards for field testing in 40 CFR 1048.101(c)
>
> §1048.101 (c) Standards for field testing. Starting in 2007, exhaust emissions may not exceed field-testing standards, as follows:
> (2) The HC + NOX standard is 3.8 g/kW-hr [2.83 g/hp-hr] . . . For natural gas-fueled engines, you are not required to measure nonmethane hydrocarbon emissions or total hydrocarbon emissions for testing to show that the engine meets the emission standards of this paragraph (c); that is, you may assume HC emissions are equal to zero
>
> §1048.101 (c)(2) ... and the CO standard is 6.5 g/kW-hr [4.85 g/hp-hr].
>
> §60.4230(a)(4)(iii) ... the requirements of subpart JJJJ apply to engines manufactured on or after July 1, 2008, if they are <500 HP.

The exceeding NSPS Subpart JJJJ emission standards are highlighted red in Table 4. The condensed list of engines exceeding NSPS Subpart JJJJ emissions standards are listed in Table 5 below.

Table 5. List of Engines Exceeding NSPS Subpart JJJJ Emissions Standards

Facility	Well Name	Make	Model	Serial Number	Horsepower	Engine Category	Mfg Year	BSFC (Btu/HP-hr)	CO*	NOx*	CH4*	NMHC*
Monuments Butte State 15-36-8-16	Greater Monument Butte B-1-9-16	Arrow	L-795	L-600315	65	2SLB	Unknown	12081	41	3.84	0.0059	48.7
Monuments Butte State 15-36-8-16	Monument Butte East State R-36-B-16	Arrow	L-795	L-600319	65	2SLB	Unknown	12081	137.2	0.1	0.0039	75.7
Monument Butte State 15-2-9-16	South Monument Butte W-2-9-16	Arrow	L-795	L600300	Unknown	2SLB	Unknown	12081	78.4	0.21	0.0024	64.4
Monument Butte State 15-2-9-16	South Monument Butte V-2-9-16	Arrow	L-795	L-600301	Unknown	2SLB	Unknown	12081	70.3	0.2	0.0022	58.2
Monument Butte 1-14-9-16	Greater Monument Butte T-2-9-16	Arrow	L-795	600445	65	2SLB	Unknown	12081	126.1	0.12	0.0039	86.3
Monument Butte 1-14-9-16	Greater Monument Butte A-11-9-16	Arrow	L-795	L600415	65	2SLB	Unknown	12081	76.7	0.53	0.0026	64.9
Wells Draw 1-4-9-16	GMBU F-3-9-16	Arrow	L-795	600575	78.3	2SLB	Unknown	12081	72.4	0.17	0.0023	25.9
Ashley 13-11-9-15	GMBU D-14-9-15	Arrow	L-795	L601156	65	2SLB	Unknown	12081	34.4	2.38	0.0024	33.3
Ashley 13-11-9-15	GMBU A-15-9-15	Arrow	L-795	L-601160	65	2SLB	Unknown	12081	77.4	0.29	0.0023	28.1
Ashley 10-10-9-15	GMBU 10-9-15	Arrow	L-795	L-601114	65	2SLB	Unknown	12081	94.5	0.28	0.0044	28.9
Ashley 12-11-9-15	GMBU T-10-9-15	Arrow	L-795	L-601080	65	2SLB	Unknown	12081	92.03	0.63	0.0029	47.8
Ashley 14-2-9-15	Greater Monument Butte W-2-9-15	Arrow	L-795	600390	65	2SLB	Unknown	12081	110.7	0.14	0.0033	36
Ashley 14-2-9-15	GMBU R-2-9-15	Arrow	L-795	600807	78.3	2SLB	Unknown	12081	27.6	0.25	0.0018	14.5

Johan (Federal) 14-14-9-16 CTB	GMBU C-23-9-16	Arrow	L-795	AEL-79S13S	65	2SLB	Unknow	12081	67.8	0.48	0.22	38.8
Federal 1-13-9-16 CTB	GMBU F-18-9-17	Arrow	L-795	600610	78.3	2SLB	Unknow	12081	59.5	0.18	0.65	32.5
Jonah 9-12-9-16 CTB	GMBU P-7-9-17	Arrow	L-795	ABL 795018	65	2SLB	2013	12081	53.8	0.23	0.69	33.1
Moon 1-29-4-2	Moon 1-29-4-2	Ajax	E-42	67245	42	4SRB	2009	13300	1348.4	0	6.85	576.6
Ashley Federal 12-26-9-15	GMBU T-27-9-15	Ajax	E-565	86395	42	2SLB	2014	13300	5.53	0.04	2.5	114.5
Ashley Federal 12-26-9-15	GMBU K-27-9-15	Ajax	E-565	86392	42	2SLB	2014	13300	5.64	0.025	1.11	52.3

*Performance test results are in grams/hp-hr

Attachment A – AST Performance Test Report

Attachment B – Engine Inspection Checklists

Spark Ignited 4 Stroke 2,160hr Inspection Checklist

Inspection Date	
Inspection Well Location	Host Well Location
Engine Model Type	
Engine Identification Number	PM Identification Number

Coolant Hose Inspection

	Repaired/Replaced	Yes/No
Coolant Hose Leakage-Are there signs of moisture, seeps, drips on or near connections		
Coolant Hose Heat Damage- Are there signs of hardened, brittle, or cracks in hose		
Coolant Hose Abrasion Damage- Are hoses scuffed, gouged, or showing cords		
Coolant Hose Oil/Chemical Damage- Are hoses soft, gooey, or showing bulges		
Overall Coolant Hose Condition		Good

Fan Belt Inspection

	Repaired/Replaced	Yes/No
Fan Belt Loose- Is belt excessively loose, more than 1/2" freeplay		
Fan Belt Worn or Damaged- Is belt excessively worn, or missing pieces		
Fan Belt Oil/Chemical Damage-Is belt soft, gooey or distorted		
Overall Fan Belt Condition		Good

Spark Plug Inspection

	Repaired/Replaced	Yes/No
Spark Plug Worn- Is electrode rounded, or narrower than when new		
Spark Plug Damaged- Is elecrode damaged or is spark plug missing any part of insulator		
Spark Plug Deposits- Is there signs of ash, oil or foreign matter on spark plug		
Overall Spark Plug Condition		Good

	Yes/No
Take Oil Sample For Analysis	
Engine Oil Changed	
Engine Oil Filter Changed	

Inspectors Name

COMMENTS:

Spartk Ignited 2 Stroke Lean Burn Yearly Inspection Checklist

Inspection Date
Inspection Well Location
Engine Model Type
Engine Identification Number

Engine Kills

	Complete
Test temperature kill by crossing button to gauge frame, adjust kill to 210 F.	
Trip over speed kill if applicable.	
Trip vibration kill on ajax, adjust if needed.	
Drain oil out of lube box, ensure that the kills work.	
Trip vibration kill on sampson post, adjust if needed.	
Test production line pressure kill.	
Drain crank case oil and ensure that crank case oil level kill works.	

Engine Service

	Complete
Turn gas off at the scrubber, drain any liquids from scrubber.	
Remove both scavenger plugs and drain oil, remove debris from scavenger ports.	
Open fan access door and grease fan hub, check belt condition and tension.	
Clean radiotor fins with brush and compressed air.	
Remove oil cup from air cleaner drain oil and clean all three parts with solvent and compressed air.	
Check conditon of powerband belt, tighten if necessary.	
Check condition of trace pump belt.	
Check condition of spark plug.	
Grease and inspect system and components.	
Check love joy union for proper alignment or wear.	
Check kill wires and repair if needed.	
Replace oil to proper level.	

Pumping Unit Service

	Complete
Grease pumping unit	
Grease trace pump	
Grease saddle bearing	
Grease tail bearing	
Grease rod rotator	
Ensure that all grease lines are hooked up and in proper working condition.	
Check oil level in gear reducer, add or replace if needed.	

Inspectors Name

Spartk Ignited 2 Stroke Lean Burn 4,320hr Inspection Checklist

Inspection Date	
Inspection Well Location	Host Well Location
Engine Model Type	
Engine Identification Number	PM Identification Number

Coolant Hose Inspection

	Comments	Yes/No
Coolant Hose Leakage-Are there signs of moisture, seeps, drips on or near connections		
Coolant Hose Heat Damage- Are there signs of hardened, brittle, or cracks in hose		
Coolant Hose Abrasion Damage- Are hoses scuffed, gouged, or showing cords		
Coolant Hose Oil/Chemical Damage- Are hoses soft, gooey, or showing bulges		
Overall Coolant Hose Condition		Good

Fan Belt Inspection

	Comments	Yes
Fan Belt Loose- Is belt excessively loose, more than 1/2" freeplay		
Fan Belt Worn or Damaged- Is belt excessively worn, or missing pieces		
Fan Belt Oil/Chemical Damage-Is belt soft, gooey or distorted		
Overall Fan Belt Condition		Good

Spark Plug Inspection

	Comments	Yes
Spark Plug Worn- Is electrode rounded, or narrower than when new		
Spark Plug Damaged- Is elecrode damaged or is spark plug missing any part of insulator		
Spark Plug Deposits- Is there signs of ash, oil or foreign matter on spark plug		
Overall Spark Plug Condition		Good

Take Oil Sample For Analysis	No
Engine Oil Changed	No
Engine Oil Filter Changed	N/A

Inspectors Name